

Chapter 1 Problems: (48, 58, 63, 76, 92, 107)

Q48) Oil Pressure = $\frac{\text{Force (pounds)}}{\text{area (in}^2\text{)}} = \frac{18000 \text{ lb}}{4.9087 \text{ in}^2} = 3666.95 \text{ lb/in}^2$ $\frac{0.0689 \text{ bar}}{1 \text{ lb/in}^2}$

$1 \text{ lb/in}^2 = 0.0689 \text{ bar} = [252.65 \text{ bar}]$

Q58) $\Delta P = -E \left| \frac{\Delta V}{V} \right|$ Mercury: 3,590,000 psi or 24,750 MPa

$\Delta P = -3,590,000 (-0.01) = [35,900 \text{ psi}]$

$\Delta P = -24,750 (-0.01) = [247.5 \text{ MPa}]$

Q63) $E = \frac{-\Delta P}{\Delta V/V} = \frac{F/L \cdot L}{\Delta L} = \frac{F(L)}{\Delta L} \left[\frac{EA}{L} = \frac{F}{\Delta L} \right]$

$E = 189,000 \text{ lb/in}^2$

$L = 42 \text{ inch}$

$A = \frac{\pi}{4} (0.5)^2 \text{ or } \pi (0.25)^2$

$\rightarrow 0.1963$

$\frac{F}{\Delta L} = \frac{(189,000 \text{ lb/in}^2)(0.1963)}{42 \text{ inch}}$

$\frac{F}{\Delta L} = \frac{37,110.66 \text{ lb}}{42 \text{ inch}} = [883.57 \text{ lb/inch}]$

Q76) Slugs: $\frac{1 \text{ lb}}{32.174 \text{ lb}} = [0.0311 \text{ Slugs}]$

kg: $\frac{1 \text{ lb}}{2.205 \text{ lb}} = [0.454 \text{ kg}]$

N: $\frac{1 \text{ lb}}{1 \text{ lb}} = [4.45 \text{ N}]$

Q92) Diameter of Container: $d = 150 \text{ mm}$

Weight of Container: $w = 2.25 \text{ N}$

Weight of Container filled: $W = 35.4 \text{ N}$

Depth of Container w/oil: $h = 200 \text{ mm}$

Specific Gravity of the oil: $\frac{956.14}{1000}$

Weight of oil: $35.4 \text{ N} - 2.25 \text{ N} = 33.15 \text{ N}$

Mass of oil: $\frac{33.15 \text{ N}}{9.81} = 3.379 \text{ kg}$

$[1 \text{ mm} = 10^{-3} \text{ m}]$

Volume of oil/container: $\frac{\pi}{4} (150 \times 10^{-3})^2 (200 \times 10^{-3}) = 3.534 \times 10^{-3} \text{ m}^3$

Density of oil: $\frac{3.379 \text{ kg}}{3.534 \times 10^{-3} \text{ m}^3} = 956.14 \text{ kg/m}^3$

$\text{Water} = 1000 \text{ kg/m}^3$

$\left[\gamma_{\text{oil}} = 0.95614 \text{ kg/m}^3 \right]$